CLAIMS :

1. A beamforming device comprising :

(a) a plurality of Wavelength Division Multiplexer (WDM) filters ;

(b) a plurality of delay lines connecting at least selected ones of said plurality WDM filters ; and

(c) a plurality of wave guides connecting at least selected ones of said plurality of WDM filters.

2. The beam forming device of claim 1 wherein said plurality of WDM filters, said plurality of delay lines, and said plurality of wave guides, are optical components.

3. The beam forming device of claim 2 wherein said plurality of WDM filters comprises Array Waveguide Grating (AWG) filters.

4. The beam forming device of claim 2 wherein said plurality of input lines, said plurality of WDM filters, said plurality of delay lines, and said plurality of wave guides are integrated on a common substrate.

5. The beam forming device of claim 1 wherein a first subset (1) of said plurality of WDM filters act as port demultiplexers, the elements of said subset (1) being connected to the elements of a subset (2) of said plurality of WDM filters acting as beam demultiplexers, said subset (1) and (2) being connected by said plurality of delay lines ; said subset (2) is connected to a subset (3) of said plurality of WDM filters acting as fiber multiplexers, said subsets (2) and (3) being connected by at least selected ones of said plurality of wave guides ; said subset (3) is connected to a subset (4) of said plurality of WDM filters acting as beam multiplexers, said subsets (3) and (4) being connected by at least selected ones of said plurality of wave guides.

6. The beam forming device of claim 5 wherein said plurality of WDM filters, said plurality of delay lines, and said plurality of wave guides, are optical components.

7. The beam forming device of claim 6 wherein said plurality of WDM filters comprises Array Waveguide Grating (AWG) filters.

8. The beam forming device of claim 6 wherein said plurality of WDM filters, said plurality of delay lines, and said plurality of wave guides are integrated on a common substrate.

9. The beam forming device of claim 6 further comprising a plurality of photodetectors optically connected to outputs of said subset (4) of said plurality of WDM filters acting as beam

multiplexers.

10. The beam forming device of claim 1 further comprising a plurality of wave guide splitters, said plurality of wave guide splitters being connected to at least selected ones of said plurality of WDM filters, by said plurality of delay lines.

11. The beam forming device of claim 10 wherein said plurality of wave guide splitters, said plurality of WDM filters, said plurality of delay lines, and said plurality of wave guides, are optical components.

12. The beam forming device of claim 11 wherein said plurality of WDM filters comprises Array Waveguide Grating (AWG) filters.

13. The beam forming device of claim 11 wherein said plurality of wave guide splitters said plurality of WDM filters, said plurality of delay lines, and said plurality of wave guides are integrated on a common substrate.

14. The beam forming device of claim 10 wherein said plurality of wave guide splitters are connected to a subset (1) of said plurality of WDM filters acting as fiber multiplexers, by said plurality of delay lines; said subset (1) is connected to a subset (2) of said plurality of WDM

filters acting as beam multiplexers, said subset (1) and (2) being connected through said plurality of wave guides.

15. The beam forming device of claim 14 wherein said plurality of wave guide splitters, said plurality of WDM filters, said plurality of delay lines, and said plurality of wave guides, are optical components.

16. The beam forming device of claim 15 wherein said plurality of WDM filters comprises Array Waveguide Grating (AWG) filters.

17. The beam forming device of claim 15 wherein said plurality of waveguide splitters, said plurality of WDM filters, said plurality of delay lines, and said plurality of wave guides are integrated a common substrate.

18. The beam forming device of claim 15 further comprising a plurality of photodetectors optically connected to outputs of said subset (2) of said plurality of WDM filters acting as beam multiplexers.

19. The beam forming device of claim 1 further comprising a plurality of wave guide combiners, said plurality of wave guide combiners being connected to at least selected ones of said plurality

of WDM filters, by said plurality of wave guides.

20. The beam forming device of claim 19 wherein said plurality of wave guide combiners ,said plurality of WDM filters, said plurality of delay lines, and said plurality of wave guides, are optical components.

21. The beam forming device of claim 20 wherein said plurality of WDM filters comprises Array Waveguide Grating (AWG) filters.

22. The beam forming device of claim 20 wherein said plurality of wave guide combiners, said plurality of WDM filters, said plurality of delay lines, and said plurality of wave guides are integrated on a common substrate.

23. The beam forming device of claim 19 wherein a subset (1) of said plurality of WDM filters acting as port demultiplexers is connected to a subset (2) of WDM filters acting as beam demultiplexers, by said plurality of delay lines ; said subset (2) is connected to said plurality of of fiber combiners, said subset (2) and said fiber combiners being connected by said plurality of wave guides.

24. The beam forming device of claim 23 wherein said plurality of wave guide combiners, said

plurality of WDM filters, said plurality of delay lines, and said plurality of wave guides, are optical components.

25. The beam forming device of claim 24 wherein said plurality of WDM filters comprises Array Waveguide Grating (AWG) filters.

26. The beam forming device of claim 24 wherein said plurality of waveguide splitters, said plurality of WDM filters, said plurality of delay lines, and said plurality of wave guides are integrated a common substrate.

27. The beam forming device of claim 24 further comprising a plurality of photodetectors optically connected to outputs of said fiber combiners.

28. The beam forming device of claim 2 further comprising a plurality of wave guide splitters, a plurality of photodetectors and a plurality of electrical switches, said plurality of wave guide splitters being connected to a subset (1) of WDM filters acting as beam demultiplexers by said plurality of delay lines; said subset (1) being connected to a subset (2) of WDM filters acting as fiber multiplexers by at least selected ones of said wave guides; said subset (2) of WDM filters having their outputs connected to said plurality of photodetectors by at least selected ones of said wave guides; and at least selected ones of said photodetectors having their outputs connected

to at least selected ones of said electrical switches by electrical lines.

29. The beam forming device of claim 28 wherein said plurality of WDM filters comprises Array Waveguide Grating (AWG) filters.

30. The beam forming device of claim 28 wherein said plurality of waveguide splitters, said plurality of WDM filters, said plurality of delay lines, said plurality of photodetectors, said plurality of electrical switches, and said plurality of wave guides are integrated on a common substrate.

31. The beam forming device of claim 1 wherein a first subset (1) of said plurality of WDM filters acting as port/beam demultiplexers is connected to a second subset (2) of WDM filters acting as fiber multiplexers, said subset (1) and said subset (2) being connected by said plurality of delay lines, said subset (2) is connected to a subset (3) of WDM filters acting as beam multiplexers, said subset (2) and said subset (3) being connected by said plurality of wave guides.

32. The beam forming device of claim 31 wherein said plurality of WDM filters, said plurality of delay lines, and said plurality of wave guides are optical components.

33. The beam forming device of claim 32 wherein said plurality of WDM filters comprises Array

Waveguide Grating (AWG) filters.

34. The beam forming device of claim 32 wherein said plurality of WDM filters, said plurality of delay lines, and said plurality of wave guides are integrated a common substrate.

35. The beam forming device of claim 32 further comprising a plurality of photodetectors optically connected to outputs of said subset (3) of WDM filters by at least selected ones of said plurality of wave guides.

36. The beam forming device of claim 2 further comprising a plurality of electrical wave guide combiners and a plurality of photodetectors, a subset (1) of WDM filters acting as port demultiplexers being connected to a subset (2) of WDM filters acting as beam demultiplexers by said plurality of delay lines; said subset (2) being connected to a subset (3) of WDM filters acting as fiber multiplexers by at least selected ones of said wave guides; said subset (3) of WDM filters having their outputs connected to said plurality of photodetectors by at least selected ones of said wave guides; and at least selected ones of said photodetectors having their outputs connected to at least selected ones of said electrical wave guide combiners by electrical lines.

37. The beam forming device of claim 36 wherein said plurality of WDM filters comprises Array Waveguide Grating (AWG) filters.

38. The beam forming device of claim 36 wherein said plurality of wave guide combiners, said plurality of WDM filters, said plurality of delay lines, said plurality of photodetectors, and said plurality of wave guides are integrated on a common substrate.

39. The beamforming device of claim 5 wherein the elements of said subset (2) are arranged according to an In-Line-Switched architecture, thereby to concentrate all wave guide cross-overs in an area between said subset (2) and said subset (3).

40. The beamforming device of claim 5 wherein the elements of said subset (2) are arranged according to a Network-Switched architecture.

41. The beam forming device of claim 2 further comprising a plurality of electrical wave guide combiners and a plurality of photodetectors, wherein a subset (1) of WDM filters acting as port demultiplexers is connected to a subset (2) of WDM filters acting as beam demultiplexers by said plurality of delay lines, said elements of subset (2) have their outputs connected to said plurality of photodetectors by at least selected ones of said wave guides, and said photodetectors have their outputs connected to at least selected ones of said electrical wave guide combiners by electrical lines.

42. The beam forming device of claim 41 wherein said plurality of WDM filters comprises Array Waveguide Grating (AWG) filters.

43. The beam forming device of claim 41 wherein said plurality of wave guide combiners, said plurality of WDM filters, said plurality of delay lines, said plurality of photodetectors, and said plurality of wave guides are integrated on a common substrate.

44. The beam forming device of claim 2 further comprising a plurality of electrical wave guide combiners, a plurality of photodetectors and a plurality of optical switches, wherein a subset (1) of WDM filters acting as port demultiplexers is connected to a subset (2) of WDM filters acting as beam demultiplexers by said plurality of delay lines, elements of subset (2) are connected to at least selected ones of said optical switches by at least selected ones of said wave guides, said optical switches having their outputs connected to at least selected ones of said photodetectors by at least selected ones of said wave guides, and said photodetectors have their outputs connected to at least selected ones of said electrical wave guide combiners by electrical lines.

45. The beam forming device of claim 44 wherein said plurality of WDM filters comprises Array Waveguide Grating (AWG) filters.

46. The beam forming device of claim 44 wherein said plurality of wave guide combiners, said

plurality of WDM filters, said plurality of delay lines, said plurality of photodetectors, said plurality of optical switches, and said plurality of wave guides are integrated on a common substrate.

47. A method of beamforming comprising the steps of :

(a) synthesizing a plurality of optical wavefronts each comprising of plurality of optical wavelengths;

(b) receiving a plurality of incoming electrical wavefronts with an antenna;

(c) mixing said plurality of optical wavefronts with said plurality of incoming electrical wavefronts by optical modulation to provide a plurality of resultant optical wavefronts;

(d) directing each resultant optical wavefront to a predetermined set of delay lines; and

(e) separating each resultant optical wavefronts in order to direct each one to a different output.

48. The method of beamforming as in claim 47 wherein the step of synthesizing a plurality of optical wavefronts, includes the steps of :

(a) specifically selecting a subset of said plurality of optical wavelengths in accordance with the set of delay lines desired ; and

(b) specifically selecting a subset of said plurality of optical wavelengths in accordance with the output desired.

49. The method of claim 48 wherein the step of directing each resultant optical wavefront to a predetermined set of delay lines, includes providing WDM filters capable of channeling each resultant optical wavefront into the predetermined delay line, by dispersing the wavelengths contained in each resultant optical wavefronts.

50. A method of separating a plurality of electromagnetic wavefronts included in an electromagnetic radiation, the method comprising the steps:

(a) providing a plurality of optical components;

(b) arranging said optical components to form a network having a plurality of inputs and a plurality of outputs, said components being arranged so as to separately direct each one of said electromagnetic wavefronts to one of said outputs.

51. The method of claim 50, wherein said electromagnetic wavefronts each include a plurality of wavelengths, and wherein the directing of said electromagnetic wavefronts to one of said outputs, is achieved by channeling selected ones of said wavelengths into selected ones of said optical components.

52. The method of claim 50 further comprising the step of providing a plurality of electrical components.

53. The method of claim 50, wherein said electromagnetic wavefronts each include a plurality of wavelengths, and wherein the directing of said electromagnetic wavefronts to one of said outputs, is achieved by channeling selected ones of said wavelengths into selected ones of said optical and/or electrical components.

54. The method of claim 50, wherein said optical components include WDM filters, delay lines and wave guides.

55. The method of claim 54, wherein said optical components further include splitters, combiners and switches.

56. The method of claim 54, wherein said WDM filters comprise Array Waveguide Grating (AWG) filters.

57. The method of claim 54, wherein said WDM filters, said delay lines and said wave guides are integrated on a common substrate.